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## (54) Organic electroluminescent devices with improved stability and efficiency

(57) An organic luminescent layer for use in an electroluminescent device with improved operating life includes an organic host material capable of sustaining both hole and electron injection and recombination. The layer also includes at least two dopants: a first dopant capable of accepting energy of electron-hole combinations in the host material; and a second dopant capable of trapping the holes from the host material. The first dopant being selected so that the band gap energy of the first dopant is less than the bandgap energy of the host material and the second dopant being selected to have a hole trapping energy level above the valance band of the host material.

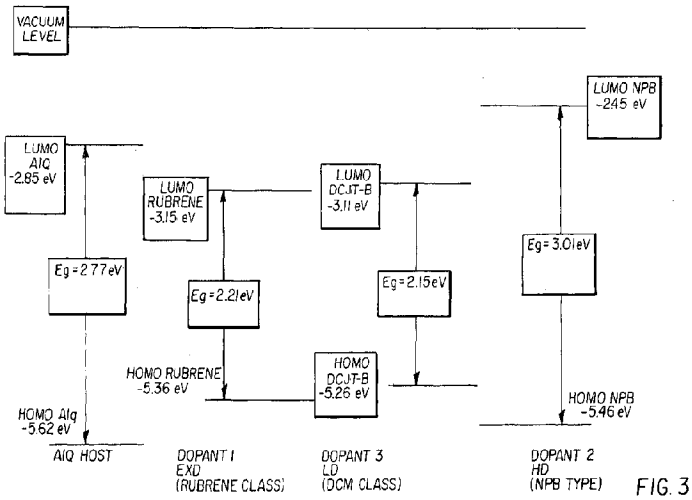


FIG. 3

EP 1 162 674 A3

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# EUROPEAN SEARCH REPORT

Application Number
EP 01 20 2011

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int.Cl.7) |
|---|---|---|---|
| X | WO 99 53724 A (UNIV PRINCETON ;UNIV SOUTHERN CALIFORNIA (US)) 21 October 1999 (1999-10-21) * page 39, line 15-18 * * page 40, line 11-17 * | 1,2,4-7, 9 | H01L51/20 C09K11/06 H05B33/00 H05B33/02 H05B33/14 |
| Y,D | Y. HAMADA ET AL.: "Red organic light-emitting diodes using an emitting assist dopant" APPLIED PHYS. LETT., vol. 75, no. 12, 20 September 1999 (1999-09-20), pages 1682-1684, XP002196211 * column 2 - column 3; figure 1 * | 3 | |
| A | | 1,2,4-10 | |
| Y | FATEMI D J ET AL: "HIGHLY FLUORESCENT MOLECULAR ORGANIC COMPOSITES FOR LIGHT-EMITTING DIODES" SYNTHETIC METALS, ELSEVIER SEQUOIA, LAUSANNE, CH, vol. 85, 1997, pages 1225-1228, XP002911748 ISSN: 0379-6779 * column 6 * | 3 | TECHNICAL FIELDS SEARCHED (Int.Cl.7) H05B |
| A | | 1,2,4-10 | |
| A | HAMADA Y ET AL: "INFLUENCE OF THE EMISSION SITE ON THE RUNNING DURABILITY OF ORGANIC ELECTROLUMINESCENT DEVICES" JAPANESE JOURNAL OF APPLIED PHYSICS, PUBLICATION OFFICE JAPANESE JOURNAL OF APPLIED PHYSICS. TOKYO, JP, vol. 34, no. PART 2, 1 July 1995 (1995-07-01), pages 824-826, XP002061754 ISSN: 0021-4922 * the whole document * | 1-6,9 | |

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The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| MUNICH | 24 April 2002 | Doslik, N |

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## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int.Cl.7) |
|---|---|---|---|
| A | US 5 601 903 A (FUJII TAKANORI ET AL)<br>11 February 1997 (1997-02-11)<br>* examples 1-3 * | 1-10 | |

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| MUNICH | 24 April 2002 | Doslik, N |

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24-04-2002

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| WO 9953724 A | 21-10-1999 | US 6287712 B1 | 11-09-2001 |
| | | US 6210814 B1 | 03-04-2001 |
| | | US 6312836 B1 | 06-11-2001 |
| | | AU 3486199 A | 01-11-1999 |
| | | WO 9953724 A1 | 21-10-1999 |
| US 5601903 A | 11-02-1997 | JP 7065958 A | 10-03-1995 |

EPO FORM P0459

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